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ABSTRACT

The use of space standards and comparative space data in university space allocation processes are examined. Current space standards and space utilization measures are reviewed. The relationship of space allocation to other research topics and to university decision-making processes is also addressed. The following methods of space comparison are covered: professionally-developed space standards, inter-university or external data, and intra-university or internal data. Concerns regarding the implementation of space comparisons include: a campus space inventory, the use of computer retrievals, and types of analyses (e.g., review of all space within a building, review of types of space). Two space allocation goals for research universities are proposed: provide appropriate support for educational, research, or support activities; and utilize space effectively. In addition, five criteria are suggested to evaluate how well specific space allocation proposals achieve these goals. It is suggested that space needs of different academic fields differ substantially. Some standards can be uniform university-wide, while others must vary by academic field. In using space standards to estimate space requirements for a program, it is better to limit the estimate to the total net square feet required. (SW)

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THE USE OF STANDARDS AND COMPARATIVE SPACE DATA FOR SPACE ALLOCATION

by

Michael E. Baker

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Introduction

Space allocation analysis can be characterized by a quote from Charles Lamb:

> "Nothing puzzles me more than time and space, and yet nothing puzzles me less, for I never think about them."[1]

For those who would think about space allocation, this paper examines the use of space standards and comparative space data in university space allocation processes. The purpose of this paper is to summarize some of the available space standards, review several space utilization measures, and discuss the issues of using standards, of developing comparative data, and of using either in the space allocation process. Before reviewing space comparison methods, some comments are presented, in the next two sections, about the relationship of space allocation to other research topics and to university decision making processes.

Relationship to Other University Research Issues

Space allocation and comparison are similar to at least two familiar institutional research topics. Space comparison is similar to faculty activity analysis. Specifically, there is a presumption that the use of a resource (space or faculty time) can be analyzed by utilization for particular purposes (instruction, research, etc.) and that utilization patterns can be established by field or institution. Space comparison is also similar to unit costing. Unfortunately, the greater the depth of comparative analysis of space allocations, or program costs, the more difficult standardization or equivalency seem to become (for the measures involved) because of program or institution idiosyncracies.

Space allocation is different, however, than the familiar topic of budget allocation in two important ways. First, space is not easily divisable. Someone can change a budget allocation by $5,000 but it is not practical to reallocate one-third of a laboratory. Second, space allocations are adjusted relatively infrequently. The occupancy of space over time also leads to a sense of ownership. The net result of these factors is that space allocations are subject to even more "political" discussions than are budget allocations. This serves to raise the stakes for the space analyst or planner and also magnifies the problems associated with making meaningful space comparisons.

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[1] Lamb

Space Allocation Goals & Institutional Processes

Space allocation comparisons, of necessity, focus on the efficiency of space utilization: how much activity takes place per square foot of space. It is vital, however, to remember both the insitution's goals for its space and the decision making process at the institution.

The author has proposed two space allocation goals for research universities:

- Provide appropriate support for educational, research, or support activities; and,
- Utilize space effectively.

Five criteria are suggested to evaluate how well specific space allocation proposals achieve these goals:

- Appropriate Support
  - *Suitability for Requirements.* Each activity at a university requires a quantity of space of a certain type(s) to support that activity. Typical functional requirements include: classrooms, laboratories, offices, study and library areas, special use such as athletics, general use such as meeting rooms, and support such as shop and computer areas.
  - *Proximity.* Activities do not occur in a vacuum. Program location should take into account the inter-relationships with other functions. Good location choices can enhance and stimulate interactions between related units.
- Effectiveness
  - *Financial Cost and Return.* Both capital and operating costs are important issues in space decisions. Sometimes operating costs are overlooked. One criterion is whether an activity can generate enough income to justify the space use. For example, if space costs $10 per square foot per year to operate and if 10% of total research cost is justified by physical overhead, then revenue of $100 per square foot per year is required to cover full, average space costs. Of course, as with academic department operating budgets, endowment income may be used to support critical educational functions that do not generate sufficient income from their activities.
  - *Strategic Importance.* Since space, as is money, is a scarce resource, strategic planning is a critical tool in deciding priorities.
  - *Efficiency.* Since space is expensive to build and operate, efficiency is important in making allocations. Efficiency has the value of being a rational metric in an area where there is a great deal of subjectivity. In reality, as the following sections will discuss, actual measures of efficiency are relative and subjective because of measurement and definitional problems.

The complexity and obvious need to make trade-offs among allocation criteria underscore the importance of the allocation process. Richard Pattenaude has aptly described his view of space allocations:

> "In my mind politics dominate the decision making process. Like it or not one is faced with the reality that the effective utilization of space, a key institutional resource, is dependent on political factors."[2]

It is critical to understand that the political factors and institutional decision making process provide the context in which space comparisons function. The comparisons are a very useful component, but just one component in the overall analysis and allocation activity.

Qualitative Issues

Before discussing the three methods of making space comparisons, note should be made of the effect of space quality issues and institutional idiosyncracies on allocation and comparison. A major comparison factor can be the physical differences in buildings. For example, the placement of exterior windows often determines the dimension of perimeter offices. A university may desire 200 square foot offices for senior faculty. Campus buildings, however, may only provide offices near windows of 180 square feet in newer buildings and 240 square feet in older structures. Building codes are another factor that may determine the architectural design of existing space. Quality differences in space may also affect user decisions about the desirability of particular facilities. Jon Regnier has summarized the importance of qualitative factors:

> The qualitative ranking of physical facilities may be a new experience... It will be increasingly important to develop ratings and gather statistics to help choose the order of renovations and provide comparative data to explain poor utilization in some older or even poorly designed new facilities.[3]

The distribution of space can also impact the decision process. As an example, at Carnegie-Mellon University (CMU) several buildings are occupied by departments in two or more colleges. Other universities have more buildings devoted to activities in one college. This distribution at CMU means that space issues, that may be solved at the dean's level at other colleges, must go to a higher administrative level for resolution. Having set the context for space comparisons, the following sections describe three comparison methods.

[2] Pattenaude

[3] Regnier

Methods of Space Comparison

Three methods of space comparison exist: using professionally-developed space standards, using inter-university or external data, and using intra-university or internal data. Each of these methods will be discussed in turn, with examples and a review of the strengths and weaknesses of each approach.

Professionally-Developed Space Standards

Professionally-developed space standards come from two types of input: empirical research on space usage and analysis of the space requirements for particular activities. The advantage of these standards is that they include professional judgement of space and facilities planners, or architects, about space requirements for offices, classrooms, or laboratories. There are two disadvantages with these standards. First, since they are developed by professionals, they have a degree of subjectivity. Second, the standards implicitly assume a particular level of operation in terms of both scope and quality. An institution operating at, or near, the assumed level would find the standards useful. Another college, with substantially different quality, or scope of programs, would find the standards of little help.

Michael Saphier provides an example of differences in standards in his book, *Office Planning and Design*.[4] In Saphier's example, one law firm plans 270 square feet for senior partner offices. Another firm used a standard of 330 square feet for similar offices, which were also to include a conference table.

Standards are generally developed to relate space needs to program activities (usually measured by full-time equivalent (FTE) students, faculty, or staff members). Table 1 shows an example of standards developed at SUNY for Biological Sciences departments.[5] To use the standards, undergraduate FTE's are calculated by converting credit hours taught to student FTE's. Graduate student FTE's are by academic majors. Standards for research and support space, and all other types of space, vary by academic fields. For example, the physical sciences require more space than the social sciences.

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[4] Saphier

[5] SUNY

Table 1

Developed Space Standard

Biology Department

Type of Space	Type of Person Occupying Space	Space Standard (sq. ft./FTE)
Classrooms	Lower Division	9.2
	Upper Division	6.7
	Masters	1.8
	Ph.D.	1.8
Class Labs	Lower Division	42.1
	Upper Division	37.0
	Masters	40.0
	Ph.D.	20.0
Research & Support	Masters	150.6
	Ph.D.	278.1
	Faculty	180.0
Offices	Anyone	160.0
General Use	-	10% of total calculated space requirements

Inter-University or External Comparisons

Institutions have often exchanged faculty salary and program cost data. Space allocation information has also been exchanged, either by academic department or by type of space (e.g. office, laboratory). The advantage of this approach is that it yields "ballpark" information on current practice. It is also possible, by selecting the institutions carefully, to choose programs which are roughly comparable, which increases the value of the information. There are three disadvantages to this approach. First, the information reflects current practice, which may not be desirable. For example, increased construction and energy costs and the use of office landscape furnishings may dictate tighter space utilization than that required in the past. Second, program comparability may be a problem. Even if colleges are in similar financial situations and operating comparable quality programs, different education or research speciality emphasis can greatly affect space usage patterns. Third, types of space may not be consistently classified. For example, a chemical storage room might be classified as support space at one college and as research space at another. Also, some colleges may have departmentally-controlled classrooms while others may have entirely registrar-controlled classrooms.

Given the above cautions, space data exchange is relatively straightforward. Stephen Hample has provided an excellent review of the issues in comparative cost studies.[6] These sample pitfalls certainly apply to space comparisons. Table 2 provides an example of space comparison data.[7] Interestingly, the patterns of classroom and residential space per FTE student are similar at these four engineering colleges. The office and laboratory patterns are substantially different, mainly due to differences in sponsored research funding and programs at each college.

Table 2
Inter-University Space Comparison
Assigned Square Feet Per Student

	Institution			
Type of Space	A	B	C	D
Classrooms	21.8	18.1	21.5	19.8
Laboratory	102.2	39.2	135.4	93.2
Office	67.6	38.3	134.9	70.2
Residential	69.4	61.8	84.0	91.0

Intra-University or Internal Comparisons

There are two main advantages of comparing space allocation across the departments of an institution. First, issues like an institution's financial situation or quality level, that are of concern for inter-university comparisons, may be relatively constant across departments at the same university. Second, if a university has an inventory of assigned space, the data for comparisons are readily available. There are two main disadvantages with intra-university comparisons. First, classification consistency of the use of space is as much an issue for internal comparisons as it is for external analyses. Second, the diversity in space requirements for various academic departments can lead to an "apples and oranges" comparison. For example, an Art department requires more space per student than Physics which requires more than English. So instead of comparing physical science departments to social science departments it is better to compare within the same type of academic discipline. Biglan's taxonomy provides one basis for making

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[6] Hample

[7] Tannenbaum

such groupings.[8]

Table 3 shows a comparison of selected space utilization measures for four colleges at a major research university for 1978--79. This table shows both the value and the problems in making intra-university comparisons. Gross revenue per square foot shows an important policy issue. The fine arts are space intensive programs but the operating revenue they generate may not cover the cost of space used. A university must therefore support the space needs of its fine arts programs. Tuition and research revenue per square foot are also important planning variables. If these patterns continue, the science college is likely to need more space because of increases in research programs while the humanities/social sciences college is likely to need space because of instructional program increases. Square feet per faculty (shown in units of thousands) shows that humanities/social sciences faculty have the least- space-intensive instructional and research programs. Square feet per student shows the space-intensive nature of the science programs. These figures also reflect the extent of research in the science college. For that reason it would be more appropriate to examine instructional space per FTE student than total space per student. Finally, units taught per thousand square feet of space shows the less space-intensive operation of the humanities/social sciences college. This figure is biased, however, since the humanities/social sciences college uses registrar-controlled classrooms almost exclusively for instruction while the other three colleges have some departmentally-controlled classrooms and class laboratories.

[8] Biglan

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[6] Hample

[7] Tannenbaum

Table 3

Inter-University Comparison

Measure	College Science	Engr.	Fine Arts	Humanities/ Social Sci.
Gross Rev./Sq. Ft.	51	40	18	57
Tuit. Rev./Sq. Ft.	15	15	17	36
Res. Rev./Sq. Ft.	36	25	1	21
Sq. Ft.(000's)/Faculty	2.1	2.2	2.0	.7
Sq. Ft./Student	290	120	150	110
Units Taught/1000 Sq. Ft.	490	440	580	1280

Implementation

Several items concerning the implementation of space comparisons will be discussed. Comments follow about a campus space inventory, the use of computer retrievals, and types of analyses.

An inventory of space is the basis for any detailed space studies. An inventory is usually organized on a room by room basis. Items included in the inventory record would be room number, floor, building, dimensions, square feet, assigned department, type of space (e.g. office), and use of space (e.g. research). The inventory should be revised periodically to maintain reliable information.

If a university has its inventory on a computer database, then retrievals will be used to analyze the space usage. Experience at Carnegie-Mellon University has shown that a generalized retrieval language is the best way to generate reports on space. (Generalized retrieval language refers to the class of computer programs that serve report writing and database management functions.) While reports could be developed using a basic computer language like COBOL, more flexible reporting is often more useful. For example, at CMU "standard" space reports are usually run only once or twice a year. In contrast, every month a few special requests are made for space information. A typical retrieval will therefore focus on one aspect of space usage such as all the space used by one department, or all the equipment rooms on campus, or all the areas in one wing of a building. For this reason it is preferable to use a generalized retrieval language that will

make it possible to "customize" each report.

At Carnegie-Mellon, several types of space analysis have been conducted. One analysis is to review all space in a particular building. This is usually done when program expansion requires additional space in a particular building. Space in that building is then checked to see if current activities can be reorganized or shifted to free existing space for the expansion. Academic departments have also been a focus for space comparisons. This kind of analysis has been discussed in the previous section on intra-university comparisons. Type of space is another basis for analysis. Particular categories of space can be reviewed to improve space utilization. For example, office space could be studied to establish uniform policies. Storage space could be reviewed to improve usage. Classrooms could be examined to see which departmental classrooms could be turned over to the registrar to improve utilization. The type of use is still another way to look at space allocations. For example, research space could be compared to research expenditures or instructional space could be compared to credit units taught for academic departments in similar fields. Any of these analyses are aimed at improving space management.

Field inspections are a very useful method of space analysis. Touring facilities, although time-consuming, presents a unique opportunity to view the utilization of space and the kind of activities taking place. (However, it should be remembered that space is used across time and that any particular check may or may not represent a typical use of the facility being reviewed.) Since these tours reveal subjective information, it usually complements the quantitative data gained from comparative analysis. The combination of field work and comparisons provides a broad base of information for space planners and decision makers. It also provides a means of validating conclusions reached by one method.

A New Space Planning Tool

Carnegie-Mellon will be testing a new computer-based, graphical facilities management system. The system was developed by Resource Dynamics Incorporated. One feature of the system is the ability to make "what if" space change scenarios and to have a graphic summary of the results. Forecasting is also a feature of the system. In addition, a variety of attributes can be stored for each room so that occupancy, furniture, lighting, etc. could be inventoried and retrieved using the system. This package should provide similar benefits for space planning that EFPM has provided for financial planning.[9] Primary

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[9] pdegrove

benefits include greater emphasis on scenario assumptions, ease in presenting "what if" results, and review of more alternatives.

Summary and Recommendations

The advantage of conducting space comparison studies is the potential impact of better utilizing university space. Of course, the expected gains need to be weighed against the costs of conducting the studies. There are disadvantages for all of the comparison methods mentioned in this paper. For this reason, any particular study could be misleading. Therefore, using several space comparison methods, coupled with good field review, is a good strategy. The information provided by several studies is more likely to produce a consistent picture of space usage and of ways of improving utilization.

There are substantial differences in the space needs of different academic fields. While these differences would not matter significantly in the case of office space, they are very important in the case of instructional and research space. Therefore, some standards can be uniform university-wide while others must vary by academic field.

In using space standards to estimate space requirements for a program, it is better to limit the estimate to the total net square feet required. The department can then be given flexibility in how the space is set up in detail to meet particular needs. This is consistent with budgeting at many universities where a department's budget is decided centrally but the details of the budget are decided at the departmental level. (However, some general design guidelines should be established so that space is not configured in a way that would not be useful for other future users.)

In general, space standards and comparisons can be useful space management analysis techniques. But care should be given to allow flexibility for the characteristics of individual programs. W.E. Stallman provides an appropriate summation:

> "The task of evaluating space requirements is difficult and time-consuming, but it is essential for making wise decisions on space assignments and provides an excellent opportunity for reviewing/correcting Office of Space Utilization records and procedures."[10]

[10] Stallman

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